

What is claimed is:

1. A combination for use in aligning the filament of a flashlight lamp bulb with the principle axis of a flashlight reflector, the combination comprising:

5 a lamp bulb having a bulb portion, a pair of electrodes and a filament extending between the electrodes;

10 a lamp base adapted to receive the electrodes of the lamp bulb, the lamp bulb being secured to the base so that the electrodes extend through the base, the bulb portion is disposed adjacent the base, and the filament of the lamp bulb is aligned with a predetermined axis extending through the base, and wherein the base is

15 configured to be removably seated in a bore provided in a base receiver mounted adjacent to a forward end of the flashlight so as to align the predetermined axis of the base with the principal axis of the reflector.

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2. A combination according to claim 1, wherein the lamp bulb comprises a bi-pin lamp bulb.

3. A combination according to claim 1, wherein the lamp base comprises a ceramic material.

4. A combination according to claim 1, wherein the lamp base comprises a solid of revolution with two holes  
5 extending through the base in a direction of the axis of revolution.

5. A combination according to claim 4, wherein the predetermined axis is the axis of revolution.

6. A combination according to claim 4, wherein the lamp base generally comprises a frustum of a right circular  
10 cone having a base end, a truncated end, and a tapered sidewall interposed between the two.

7. A combination according to claim 6, wherein the lamp bulb is secured to the lamp base adjacent the base  
15 end.

8. A combination according to claim 6, wherein the sidewall is tapered at an angle of between 5° and 60° with respect to the axis of revolution.

9. A combination according to claim 6, wherein the sidewall is tapered at an angle of between  $5^{\circ}$  and  $20^{\circ}$  with respect to the axis of revolution.
10. A combination according to claim 6, wherein the predetermined axis is the axis of revolution.
11. A combination according to claim 1, wherein the filament is aligned so that its center is displaced 0.003 inches or less from the predetermined axis.
12. A combination according to claim 1, wherein the filament is aligned so that its center is displaced 0.001 inches or less from the predetermined axis.
13. A combination according to claim 1, wherein the lamp bulb is secured to the base with an adhesive.
14. A combination according to claim 1, wherein the center of the filament of the lamp bulb is aligned with predetermined axis.

15. A combination for use in aligning the filament of a lamp bulb with the principle axis of a reflector, the combination comprising:

5 a bi-pin lamp bulb having a bulb portion, a pair of electrodes and a filament extending between the electrodes;

10 a lamp base comprising a conical frustum having a circular base end, a circular truncated end parallel to and concentric with the base end, and a conical-shaped side wall interposed between the two, the lamp base further including two holes extending through the base in a direction parallel to an axis extending through the center of the base end and truncated end and adapted to receive the electrodes of the lamp bulb;

15 wherein the lamp bulb is secured to the base so

20 that the electrodes extend through the base, the bulb portion is disposed adjacent the base, and the filament of the lamp bulb is aligned with the axis.

16. A combination according to claim 15, wherein the lamp base comprises a ceramic material.

17. A combination according to claim 15, wherein the lamp bulb is secured to the lamp base adjacent the base  
5 end.

18. A combination according to claim 15, wherein the sidewall is tapered at an angle of between 5° and 60° with respect to the axis.

19. A combination according to claim 15, wherein the sidewall is tapered at an angle of between 5° and 20° with respect to the axis.  
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20. A combination according to claim 15, wherein the filament is aligned so that its center is displaced 0.003 inches or less from the axis.

15 21. A combination according to claim 15, wherein the filament is aligned so that its center is displaced 0.001 inches or less from the axis.

22. A combination according to claim 15, wherein the lamp bulb is secured to the base with an adhesive.

23. A combination according to claim 15, wherein the center of the filament of the lamp bulb is aligned with the  
5 axis.

24. A flashlight comprising:

a barrel for retaining one or more batteries, the barrel having first and second ends;

a head assembly mounted to the first end of the barrel, the head assembly including a reflector and lens mounted in a mutually fixed relationship, the reflector including a central opening surrounding the principal axis of the reflector;

10 a lamp bulb having a filament extending between two electrodes;

15 a lamp base, the lamp bulb being secured to the base so that the lamp bulb is disposed adjacent the base and the filament of the lamp bulb is  
20 aligned with a predetermined axis extending through the base;

5 a lamp base receiver mounted adjacent the first  
end of the barrel, wherein the lamp base is  
removably seated in a complementary bore  
extending through the lamp base receiver, and  
wherein the lamp base receiver is mounted  
adjacent the first end of the barrel so that  
the lamp bulb extends through the central  
opening in the reflector and the predetermined  
axis of the lamp base is aligned with the  
principal axis of the reflector;  
10 a tail cap at the second end of the barrel;  
an electrical circuit coupling the electrodes of  
the lamp bulb to the one or more batteries; and  
a switch interposed in the electrical circuit.

15 25.

A flashlight comprising:

a barrel for retaining one or more batteries, the

~~barrel having first and second ends;~~

20 a head assembly mounted to the first end of the  
barrel, the head assembly including a reflector  
and lens mounted in a mutually fixed  
relationship, the reflector including a central

opening surrounding the principal axis of the reflector;

a lamp bulb having a pair of electrodes and a filament extending between the electrodes;

5 a lamp base adapted to receive the electrodes of the lamp bulb, the lamp bulb being secured to the base so that the electrodes extend through the base, the lamp bulb is disposed adjacent the base, and the filament of the lamp bulb is aligned with a predetermined axis extending through the base;

10 a lamp base receiver mounted adjacent the first end of the barrel, wherein the lamp base is removably seated in a complementary bore extending through the lamp base receiver, and wherein the lamp base receiver is mounted adjacent the first end of the barrel so the

15 lamp bulb extends through the central opening in the reflector and the predetermined axis of the lamp base is aligned with the principal axis of the reflector;

20 a tail cap at the second end of the barrel;



an electrical circuit coupling the electrodes of  
the lamp bulb to the one or more batteries; and  
a switch interposed in the electrical circuit.

26. A flashlight according to claim 25, wherein the  
5 lamp bulb comprises a bi-pin lamp bulb.

27. A flashlight according to claim 25, wherein the  
lamp base comprises a ceramic material.

28. A flashlight according to claim 25, wherein the  
lamp base comprises a solid of revolution with two holes  
10 extending through the base in a direction of the axis of  
revolution.

29. A flashlight according to claim 28, wherein the  
predetermined axis is the axis of revolution.

30. A flashlight according to claim 28, wherein the  
15 lamp base generally comprises a frustum of a right circular  
cone having a base end, a truncated end, and a tapered  
sidewall interposed between the two.

31. A flashlight according to claim 30, wherein the lamp bulb is secured to the lamp base adjacent the base end.

32. A flashlight according to claim 30, wherein the  
5 sidewall is tapered at an angle of between  $5^{\circ}$  and  $60^{\circ}$  with respect to the axis of revolution.

33. A flashlight according to claim 30, wherein the sidewall is tapered at an angle of between  $5^{\circ}$  and  $20^{\circ}$  with respect to the axis of revolution.

10 34. A flashlight according to claim 30, wherein the predetermined axis is the axis of revolution.

35. A flashlight according to claim 25, wherein the filament is aligned so that its center is displaced 0.003 inches or less from the predetermined axis.

15 36. A flashlight according to claim 25, wherein the filament is aligned so that its center is displaced 0.001 inches or less from the predetermined axis.

37. A flashlight according to claim 25, wherein the lamp bulb is secured to the base with an adhesive.

38. A flashlight according to claim 25, wherein the head assembly is mounted to the first end of the barrel so  
5 that the principal axis of the reflector is coincident with the axis of the barrel.

39. A flashlight according to claim 25, wherein the head assembly is removably coupled to the first end of the barrel and the switch is adapted to close the electrical  
10 circuit in response to axial movement of the head along the barrel and to open the electrical path in response to axial movement of the head in the opposite direction.

40. A method of manufacturing a lamp bulb and lamp base combination, the method comprising:

15 obtaining a lamp bulb having a bulb portion, a pair of electrodes extending from the bulb portion, and a filament extending between the electrodes within the bulb portion;

inserting the lamp bulb into a lamp base adapted to  
20 receive the electrodes of the lamp bulb until the

5 bulb portion of the lamp bulb is adjacent the  
base and the electrodes extend through the base,  
the lamp base being adapted to permit lateral  
movement of the bulb portion and electrodes with  
respect to a predetermined axis extending through  
the lamp base;

laterally adjusting the lamp bulb with respect to the  
predetermined axis of the base until the filament  
of the lamp bulb is aligned with the  
predetermined axis;

securing the lamp bulb to the lamp base to preserve  
the alignment of the filament with the  
predetermined axis.

41. A method according to claim 40, wherein the base  
15 is configured to be removably seated in a bore provided in  
a base receiver mounted adjacent to a forward end of a  
flashlight so as to align the predetermined axis of the  
base with the principal axis of a reflector of the  
flashlight.

20 42. A method according to claim 40, wherein the lamp  
bulb comprises a bi-pin lamp bulb.

43. A method according to claim 40, wherein the lamp base comprises a ceramic material.

44. A method according to claim 40, wherein the lamp base comprises a solid of revolution with two holes  
5 extending through the base in a direction of the axis of revolution.

45. A method according to claim 44, wherein the predetermined axis is the axis of revolution.

46. A method according to claim 46, wherein the lamp base generally comprises a frustum of a right circular cone  
10 having a base end, a truncated end, and a tapered sidewall interposed between the two.

47. A method according to claim 46, wherein the lamp bulb is secured to the lamp base adjacent the base end.

15 48. A method according to claim 46, wherein the sidewall is tapered at an angle of between 5° and 60° with respect to the axis of revolution.

49. A method according to claim 46, wherein the sidewall is tapered at an angle of between 5° and 20° with respect to the axis of revolution.

50. A method according to claim 46, wherein the  
5 predetermined axis is the axis of revolution.

51. A method according to claim 40, further comprising laterally adjusting the lamp bulb until the center of the filament is displaced 0.003 inches or less from the predetermined axis.

10 52. A method according to claim 40, further comprising laterally adjusting the lamp bulb until the center of the filament is displaced 0.001 inches or less from the predetermined axis.

53. A method according to claim 40, further  
15 comprising securing the lamp bulb to the base with an adhesive.

54. A method according to claim 40, further comprising securing the lamp bulb to the lamp base with a UV curing adhesive.

55. A tail cap assembly for a flashlight having a barrel with a forward end and a rearward end, the tail cap assembly comprising:

a tail cap comprising a first body portion having a first end and a second end and being adapted to removably engage the interior of the flashlight barrel at the rearward end, a second body portion attached to the second end of the first body portion and being adapted to enclose the rearward end of the flashlight barrel when the first body portion engages the barrel, and a spring seat at the first end of the first body portion, the spring seat comprising a pair of spaced apart, opposing ears, with opposing gaps provided at the ends of the opposing ears; and

a conductive spring including a base portion removably retained between the opposing ears of the spring seat, the base portion being adapted to extend outward in a radial direction through the

opposing gaps provided between the ears so as to make physical contact with the inner surface of the barrel when the tail cap is engaged with the barrel.

5 56. A tail cap assembly according to claim 55 further comprising a central cavity open to the first end of the first body portion and positioned between the opposing ears of the spring seat, and a spare bulb holder in the central cavity.

10 57. A tail cap assembly according to claim 55,

wherein the opposing faces of each ear further include a lip adapted to removably retain the spring.

15 58. A tail cap assembly according to claim 55 further comprising a circumferential channel on the outer periphery of the first body portion adjacent the second end, and a one-way seal in the circumferential channel.

59. A tail cap assembly according to claim 55, wherein the spring comprises a coil spring, and the base portion comprises an oval shaped coil, the minor diameter



of which is removably retained by the spring seat and the major diameter of which extends in a radial direction through the opposing gaps provided between the ears.

60. A tail cap assembly for a flashlight comprising:

5 a tail cap comprising an externally threaded body portion having a first end and a second end, a cap body portion attached to the second end of the threaded body portion, and a spring seat at the first end of the first body portion, the spring seat comprising a pair of spaced apart, opposing ears, with opposing gaps provided at the ends of the opposing ears; and

10 a conductive spring comprising a base portion removably retained between the opposing faces of the ears of the spring seat, the base portion being adapted to extend outward in a radial direction through the opposing gaps provided between the opposing ears.

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61. A tail cap assembly according to claim 60 further comprising a central cavity open to the first end of the threaded body portion and positioned between the opposing

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ears of the spring seat, and a spare bulb holder in the central cavity.

62. A tail cap assembly according to claim 60,  
wherein the opposing faces of each ear further include a  
5 lip adapted to removably retain the spring.

63. A tail cap assembly according to claim 60 further  
comprising a circumferential channel on the outer periphery  
of the threaded body portion adjacent the second end, and a  
one-way seal in the circumferential channel.

64. A tail cap assembly according to claim 60,  
wherein the spring comprises a coil spring, and the base  
portion comprises an oval shaped coil, the minor diameter  
of which is removably retained by the spring seat and the  
major diameter of which extends in a radial direction  
15 through the opposing gaps provided between the ears.

65. A flashlight comprising:  
a barrel for retaining a battery source of power, the  
barrel having a first and second ends and  
comprising an electrically conductive material;

a bulb positioned at the first end of the barrel;  
a tail cap adapted to removably engage the interior of  
the second end of the barrel, the tail cap  
including a spring seat positioned on the  
interior of the barrel, wherein the spring seat  
comprises a pair of opposing ears spaced apart  
from the axis of the barrel;

a conductive spring disposed between the tail cap and  
a case electrode of the battery source of power,  
the conductive spring including a base portion  
removably retained between the opposing ears of  
the spring seat and being adapted to extend  
outward in a radial direction through opposing  
gaps provided between the ears so as to make  
physical contact with the inner surface of the  
barrel when the tail cap is engaged with the  
barrel, the spring serving to provide a direct

electrical path between the case electrode of the  
battery source of power and the barrel;

an electrical circuit coupling the bulb to the battery  
source of power, the electrical circuit including  
the direct electrical path; and

a switch interposed in the electrical circuit.

66. A combination comprising:

a lamp bulb secured to a lamp base, the lamp bulb  
having a pair of electrodes and a filament  
extending between the electrodes, the lamp bulb  
being secured to the lamp base so that the center  
of the filament is aligned with a predetermined  
axis of the lamp base;

a reflector having a principal axis;

a lamp base receiver for receiving the lamp base and  
adapted to align the lamp base with the principal  
axis of the reflector.

67. A combination according to claim 66, wherein the  
lamp base includes a tapered surface concentric about the  
predetermined axis, and the tapered surface is seated  
against a matching tapered surface provided in the lamp  
base receiver and that is concentric about the principal  
axis of the reflector.

68. A combination according to claim 66, wherein the  
reflector further comprises a central opening, and wherein  
the lamp base receiver is adjacent the central opening of

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the reflector so that the lamp bulb extends through the  
central opening in the reflector.

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